

MILL CREEK 2 AND 3 HYDROELECTRIC SYSTEMS,  
MILL CREEK 2 AND 3 POWERHOUSE  
Highway 38, 7 miles East of Mentone  
Yucaipa vicinity  
San Bernardino County  
California

HAER No. CA-2272-Q

PHOTOGRAPHS

WRITTEN HISTORICAL AND DESCRIPTIVE DATA

FIELD RECORDS

HISTORIC AMERICAN ENGINEERING RECORD  
National Park Service  
U.S. Department of Interior  
1111 Jackson Street  
Oakland, California 94607

## HISTORIC AMERICAN ENGINEERING RECORD

### MILL CREEK 2 AND 3 HYDROELECTRIC SYSTEMS, MILL CREEK 2 AND 3 POWERHOUSE

HAER No. CA-2272-Q

**Location:** The Mill Creek 2 and 3 Powerhouse (MC 2 and 3 Powerhouse) is located just southeast of California State Route 38 (SR 38), immediately west and downhill from the associated penstocks. It shares a large piece of property with other associated buildings and structures such as an office, machine shop, switch rack, weld shop, ice house, garage, chlorine storage shed, walls with rubble stones laid in concrete, and two domestic water tanks. It is on USGS topographic map Yucaipa (Section 13; T.1S., R.1W.).

**Date of Construction:** #2: 1898-1899, #3: 1899-1903

**Builder:** Redlands Electric Light and Power Company

**Present Owner:** Southern California Edison Company (fee ownership and easements)  
2244 Walnut Grove Avenue  
Rosemead, CA 91770

**Use:** Powerhouse

**Significance:** The MC 2 and 3 Powerhouse is a contributing feature to the Mill Creek Hydroelectric System Historic District. The Mill Creek 2 and 3 Hydroelectric Systems are significant as early examples of high-head hydroelectric systems that still exist today in the United States. These were also some of the first commercial three-phase alternating current stations in California. Mill Creek 1 was the first to use this system in California and possibly the United States. This became the industry standard. Previous systems used either single-phase alternating current or direct current. The Mill Creek facilities also played an important role in the growth and development of the City of Redlands.

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**Date:** May, 2010

## **Part I. Description: Structural/Design Information**

### ***General Description***

The Powerhouse was originally completed on September 1, 1899, for Mill Creek 2 (MC2). An addition was finished for Mill Creek 3 (MC 3) on March 18, 1903. It consists of a tall one-story building that is rectangular in plan and is 120 feet 8 inches long by 37 feet 5 ½ inches wide. The southern 1/3 section serves the MC 2 penstock and the northern 2/3 section of the building houses MC 3.

*Exterior:* The exterior walls are constructed of poured reinforced concrete and the building has a concrete foundation. The west façade is asymmetrical. The older (southern) MC 2 section shows the imprint from the wood forms that were used to pour the concrete. The north and west elevation of the newer northern section have smooth concrete surfaces, with wood form imprints on the east elevation. The building has a side-gabled roof that is clad with corrugated metal sheets, and is supported by steel trusses of flat and angle bars covered with galvanized corrugated iron.<sup>1</sup> The moderately overhanging eaves are open, and there are purlins within the gables. There is a rectangular vented opening located within the south gable. A gabled monitor roof is situated along the ridge of the main section of the roof. The monitor roof has a moderately overhanging gabled roof with purlins. There are 36 aluminum-framed double-hung sash windows located along the west side of the monitor roof, and 22 on the east side of the roof. Those on the west side are ribbon windows, while those on the east are in pairs. The gable ends of both the building and the monitor roof are clad with corrugated metal. These windows were replaced in 1997.

The pedestrian entrance into the facility is located on the south end of the west wall. It consists of a single replacement steel door, with a small single light, that was installed in the 1990s. There was once a round brick arched opening that has been filled in on the exterior side of the main entry, although the arch remains on the interior. The original door had been replaced in the 1960s, although at that time the exterior arch remained intact.<sup>2</sup> The concrete is built up at the entrance to create easier access from the concrete paved exterior to the interior. There are newer concrete steps with steel pipe rails leading from this paved area to the rest of the property. The paved area is surrounded by poured concrete and rubble stone walls. There is an original large sliding single wood door located at the northern end of the west wall that is used to bring equipment into the building. The door is made of vertical wood boards with cross bracing. The entry is protected by a metal security gate and there is an asphalt paved driveway leading up to it. There is what appears to be an original simple metal hooded downlight fixture located above the door. There are four fixed fanlight windows located just below the roofline at the west elevation,

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<sup>1</sup> George P. Low, "The Generating, Transmission and Distribution Systems of The Edison Electric Company of Los Angeles, Cal.," *The Journal of Electricity, Power and Gas*, vol. XIII, no. 1, January, 1903, 25.

<sup>2</sup> Darrell W. Heinrich, Project Manager, Eastern Hydro Division, Southern California Edison, telephone interview by Christeen Taniguchi, November 18, 2008.

each with a single wood sash with four wedge shaped panes. There are two recessed arched window openings on both the north and south elevations. The windows have vinyl replacement sashes. Those on the south elevation have rectangular metal security grills. There are no window or door openings on the east elevation. There is, however, a corrugated metal shed roof opening on this elevation that accesses the penstock for MC 2.

There is a simple wood utility pole mounted on a concrete base that is located near the southeast corner of the building. The telephone lines to the plant are all located underground.

*Interior:* Access to the interior is via short concrete steps on the southern end of the west elevation. The steps lead down into a large tall one-story space that has an open roof structure and a scored concrete floor. The concrete steps and floor have been painted red. The interior walls are made of reinforced concrete that support an open steel truss structural system located above. The under side of the corrugated metal sheets of the roof are exposed to the interior. There are fluorescent light fixtures hanging from the steel truss roof membranes. There is also a hand operated Maris Bros. 15-ton crane, which spans the room from east to west and runs on rails on a ledge, located near the north end of the interior. Today the Powerhouse is automated using a system that was installed in 1958. The original automation system was invented by Gustaf Clingwald, who had been an operator at Santa Anita River 1 from 1910 to 1920. His system regulated the forebay water levels, governor tripping devices and melting link-bearing thermostats. These devices are now standard in the industry.<sup>3</sup> Today the MC 2 and 3 Powerhouse uses an electronic water-measuring device that feeds into Clingwald's system.

There is a built in enclosure that is located at the southwest corner of the interior. It is clad in vertical channel drop siding and has a flat roof with a corniced edge. There are two single doors, also with vertical channel drop siding, that lead into a telephone booth and a restroom with sink and toilet. The concrete steps from the primary exterior pedestrian entry extend to double as steps for the two doors on the interior enclosure.

*Located along the east interior wall:* There are electrical generators throughout the interior that are protected by steel pipe barriers. A generator converts mechanical energy into electrical energy. The generator at the southeast corner is called Unit #1 and provided electricity for MC 2 until it was put out of service. It was made by the General Electric Company with 250 K.V.A. 750 volt and 193 amp, and has patent dates ranging from 1888 to 1902. Its water wheel is a Pelton Water Wheel Company 350 horsepower Lombard Governor with the date stamp of 1904. It is 60 feet in diameter. Its wheel carries 20 buckets. When the MC 2 Powerhouse was originally constructed in November, 1899, there were two generating units. After MC 3 was added four years later, the two existing generators were taken out and moved to the Lytle Creek power station. On August 3, 1904, the current replacement unit was installed for MC 2.<sup>4</sup> Also located at the southeast corner is an Ingersoll-Rand Co. air compressor, with a General Electric

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<sup>3</sup> "Redlands Electric Light & Power Co., Edition Electric Co. of Los Angeles, Mill Creek Power houses," *National Register of Historic Places Inventory – Nomination Form*, April 30, 1985, item number 7, 9.

<sup>4</sup> *Ibid.*, item number 7, 9.

Company induction motor. Located directly to the north, also along the east wall are governor oil pumps.

The three larger generators located at the northeast corner serve MC 3. They are Unit #s 3, 4 and 5. These generators were made by the General Electric Company and have 1,000 K.V.A., 750 volt and 770 amp, with patent dates ranging from 1888 to 1902. The water wheels are made by the Doble Steam Motors Corporation with 84-inch diameter wheels of 1,300 horsepower Lombard Governors. These wheels each carry 25 buckets. The generators are three-phase, 50 cycles, and are bolted into their cast iron bases. There was once another generator with a Pelton water wheel that had served MC 3 (Unit #2). Formerly located directly to the south of the other MC 3 generators, it was removed in 1932 to MC 1 and its generator stator was replaced. The stator is the large frame on the outside diameter of the generator, which has the copper coils that generate the power.

*Located along the west interior wall:* Located near the southwest corner of the interior are two exciters for MC 2 that are no longer being used. These are smaller generators that are used to excite the field coils of the larger generators. The exciters were created by General Electric, and are MP 4-pole 30-kilowatt 125-volt continuous-current generators. Each was driven by a 24 inch Pelton Water Wheel Co. wheel.<sup>5</sup> The exciter to the south has a water wheel, with patent dates that range from 1887 to 1893. They have steel pipe barriers.

There is also an original composite switchboard for MC 2 located at the west side of the interior space, just north of the exciters. There had been another switchboard build for MC 3, but this was later taken out so that the existing board was adapted for both MC 2 and 3. Most of the switching equipment on this board was replaced in 1947,<sup>6</sup> a time when many infrastructure updates were made at Southern California Edison as a result of post-war technological improvements. Some features of the board have been replaced, such as the big breakers, although other switches are original and taken out of service. The switchboard originally operated four generators, two exciters, one output and two transformer panels.<sup>7</sup> There are switch cells located at the northwest corner of the interior within gray boxes. These were installed in the late 1980s, replacing the original old breakers and getaways that protected the generators and the consumers from electrical surges.

After passing through the Powerhouse equipment, the water goes through the tailrace, which consists of tunnels below the Powerhouse floor. Water from the tailrace connects to the intake of the MC 1 pipe line, which reuses the water.<sup>8</sup>

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<sup>5</sup> Frederick Hall Fowler, *Hydroelectric Power Systems of California and Their Extensions into Oregon and Nevada, Water-Supply Paper 493*, Washington, D. C.: Government Printing Office, 1923, 605.

<sup>6</sup> "Redlands Electric Light & Power Co., Edition Electric Co. of Los Angeles, Mill Creek Power houses," op. cit., item number 7, 9.

<sup>7</sup> Fowler, op. cit., 605.

<sup>8</sup> Robert McF. Doble, Member of the Technical Society of the Pacific Coast, "Hydro-Electric Power Development and Transmission in California," *Journal of the Association of Engineering Societies*, Vol. XXXIV, no. 3, March 1905, 88.

### *Site Information*

The MC 2 and 3 Powerhouse is elevated from street level on an approximately three to four acre parcel of land directly south of State Route 38 (SR 38). The MC 2 and 3 Powerhouse is surrounded by additional buildings and structures that helped serve the needs of the facility with asphalt paved driveways throughout the property. These buildings and structures make up the Mill Creek 2 and 3 Powerhouse site.

At the entrance to the site there is a natural stone monument, with a bronze plaque for Henry Harbinson Sinclair (for additional information on the H.H. Sinclair Monument please see Historical American Engineering Record No. CA-2272-Y). The MC 2 and 3 Powerhouse is located directly west of the asphalt driveway and is the most prominent building at this site. Immediately surrounding the powerhouse is the tailrace to the northwest, the switch rack to the west (for additional information on the switch rack please see Historical American Engineering Record No. CA-2272-R), the machine shop to the west and an office located directly south.

The machine shop is a one-story World War II era military surplus building that was likely installed at its current location in the 1960s. It has a rectangular plan and a concrete foundation. The exterior walls are made of riveted metal sheets. The moderately pitched front gabled roof is also clad with metal sheets. The roof has moderate boxed overhangs with rectangular vents located within the gables. The building has metal rain gutters. There are identical metal double doors on the west and east elevations. Each door has a fixed steel sash with four lights each and a panel below. There are metal screens protecting the glazed sections of the doors. Each pair of doors shares a single steel transom located above with four lights each. The building has a total of four windows, two each on the north and south elevations. Each window has a fixed metal sash with sixteen lights and chicken wire glass. The windows are protected by metal screens. The interior consists of one room with an open metal roof structure. The building is no longer a machine shop and most of the equipment has been taken out of the building, except for a couple of lathes and a drill press. It is currently being used for storage.

The office is a circa 1920s one-story building with a rectangular plan that has been significantly altered over the years. The building has an asymmetrical façade and a concrete foundation. The exterior walls are clad with wood channel drop siding with vertical board accents. The moderately pitched side gabled roof is clad with corrugated metal sheets. The roof has moderate overhangs, and there are rectangular wood framed vented openings located within the gables. The building also has metal rain gutters. There is a single door obscured by a security door located at the west facing façade that faces onto a concrete landing with a concrete pedestrian walkway. There is also a sliding shop door with x-shaped bracing located on the east elevation. The south elevation has an aluminum slider window with security bars. There is a short flagpole and a tree stump located in an elevated concrete lined area near the east elevation. The building originally had a wood shake roof and different wood siding which were both replaced in 1990. The interior consists of rooms with finished walls and the ceiling is exposed steel lattice.

To the east of the powerhouse is a garage and chlorine shed (for additional information on these buildings please see, Historic American Engineering Record Nos. CA-2272-S and CA-2272-T).

Directly east of the garage and chlorine shed approximately 200 feet up the hill is a potable water tank that serves the MC 2 and 3 Powerhouse. (For additional information on this building please see Historic American Engineering Record No. CA-2272-U). Directly south of the garage is a weld shop.

The weld shop is a tall one-story World War II era military surplus building that was installed at its current location in 1966. It has a rectangular plan. The north facing façade is symmetrical and the building sits on a concrete elevated platform with rubble stone cladding on the sides. The exterior walls are made of metal sheets. The moderately pitched front gabled roof is clad with metal sheets. The boxed eaves are moderately overhanging. There are rectangular vented openings located within the gables. The north facing façade consists of metal double doors with paneling. One of these doors has a rectangular vented opening at the lower panel. There is a single metal paneled door located at the west elevation. There are concrete steps and a landing at this entrance. The building has a total of four windows, two each on the east and west elevations. Each window has a fixed metal sash with sixteen lights and chicken wire glass. The windows are protected by metal screens. The interior consists of one large open space with an open metal roof structure. There are wood shelves supported by metal brackets located along the east interior wall, and metal shelf frames located on the south wall. There is a metal hooded downlight fixture and electrical boxes for this weld shop mounted on the west interior wall. The weld shop was a modern addition and was not recorded as part of this project.

To the southwest of the weld shop is the ice house and approximately 300 feet up the hill at the southeast of the ice house is a potable water tank that used to serve the cottages at the powerhouse site. (For additional information on the ice house and cottage potable water tank please see Historic American Engineering Record Nos. CA-2272-W and CA-2272-X).

To the east of the ice house and weld shop are ruins of the workers cottages, these sites are delineated by rubble stone walls. (For additional information on the workers cottage ruins please see Historic American Engineering Record No. CA-2272-V).

## **Part II: Historical Context**

Please see the Historic Context section in the general Historic American Engineering Record for the Mill Creek 2 and 3 Hydroelectric Systems (HAER No. CA-2272).

## **Part III: Sources of Information**

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"Big Deal Completed: Merger of Subsidiary Organizations of the Edison Electric Company Finally Consummated and Bonds Delivered," *Los Angeles Times*. November 8, 1902. 12.

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- Doble, Robert McF., Member of the Technical Society of the Pacific Coast. “Hydro- Electric Power Development and Transmission in California,” *Journal of the Association of Engineering Societies*. Vol. 2272IV, no. 3, March 1905.
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- “Means Much to Redlands: Big Light and Power Deal Closed,” *Los Angeles Times*. May 25, 1901, 8.
- “Mill Creek #1 Hydro Plant: America’s First Commercial 3-Phase Alternating Current Power Plant.” [circa late 1980s].
- “Monument Dedicated: Henry Harbinson Sinclair, Pioneer in Hydroelectric Work in West, Honored at Redlands,” *Los Angeles Times*. February 26, 1927, 6.
- Myers, William A. *Iron Men and Copper Wires: A Centennial History of the Southern California Edison Company*. Glendale, California: Trans-Anglo Books, c1983, 1986.
- Owens, Charles. “The Birthplace of Hydroelectric Power,” *Los Angeles Times*. June 8, 1924, G1.



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“Redlands: Electric Light and Power Company is Reaching Out,” *Los Angeles Times*. January 30, 1896.

“Redlands Electric Light & Power Co., Edition Electric Co. of Los Angeles, Mill Creek Power houses.” *National Register of Historic Places Inventory – Nomination Form*, April 30, 1985.

“Redlands: New Power Plant,” *Los Angeles Times*. May 25, 1902, 10.

Rushmore, David B. and Eric A. Lof. *Hydro-Electric Power Stations*. New York: John Wiley & Sons, Inc.; London: Chapman & Hall, Limited, 1923.

Taylor, Thomas T. “Photographs, and Written Historical and Descriptive Data: Bishop Creek Hydroelectric System, Bishop Creek, Bishop Vicinity, Inyo County, California, HAER No. CA-145,” February 7, 1994.

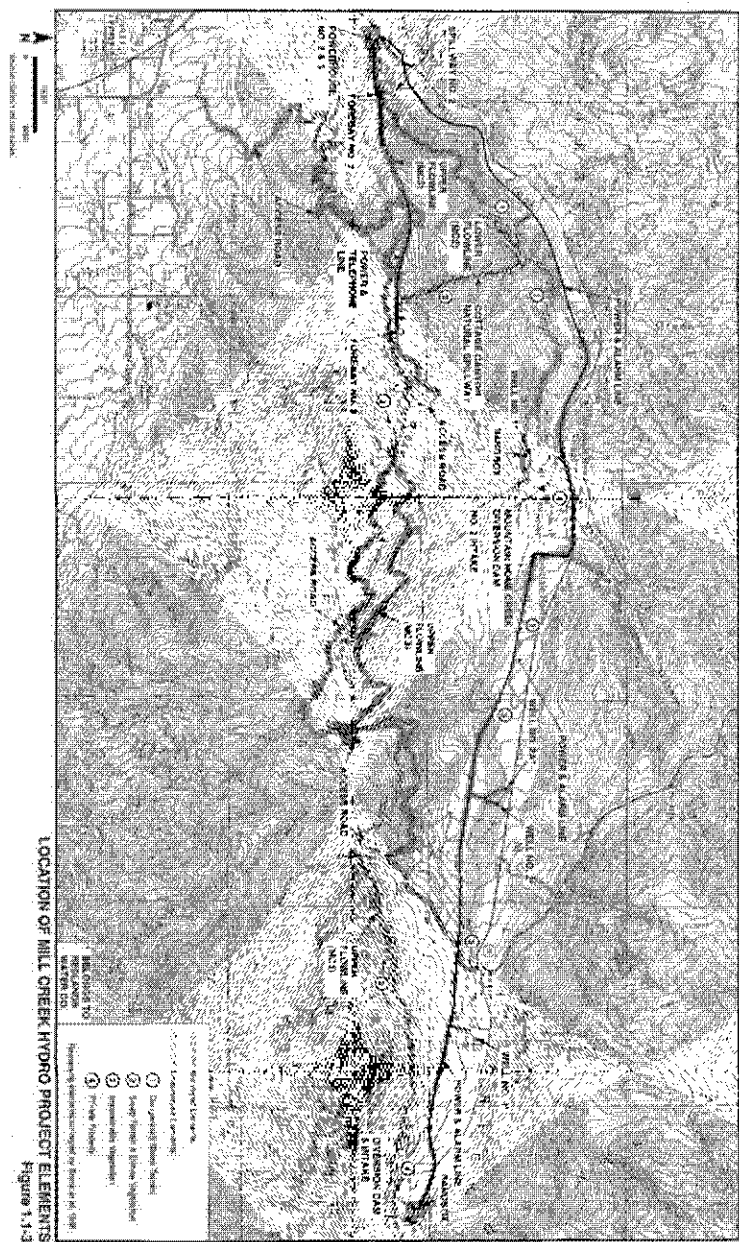
White, David R. M. “Cultural Resource Management Plan for the Southern California Edison Company Mill Creek Hydroelectric Project (FERC Project No. 1934) San Bernardino County, California,” June 1993.

“Work on New Electric Plant,” *Los Angeles Times*. March 27, 1899, 9.

#### **Part IV: Project Information**

MC 2 has not operated since 1992 when it was damaged during floods. It was not, however, decommissioned. The Southern California Edison Company, in conjunction with the San Bernardino National Forest, the agency that owns the property, proposes to formally decommission the facility. This process will include filling the sandbox and forebay with slurry, and removing the metal features. Although MC 3 is still in operation, it is also being recorded as part of this project because of the system’s close association with MC 2.

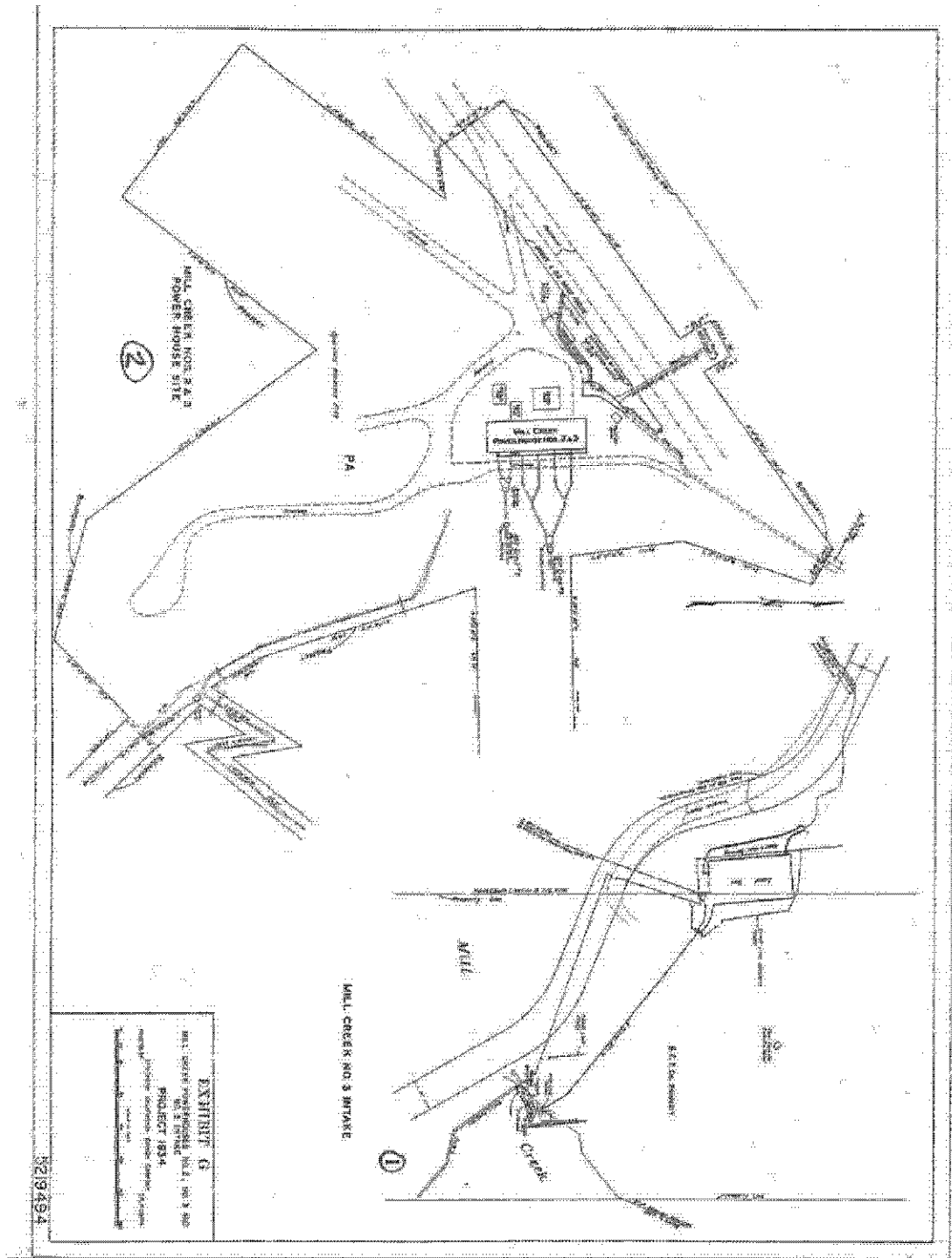
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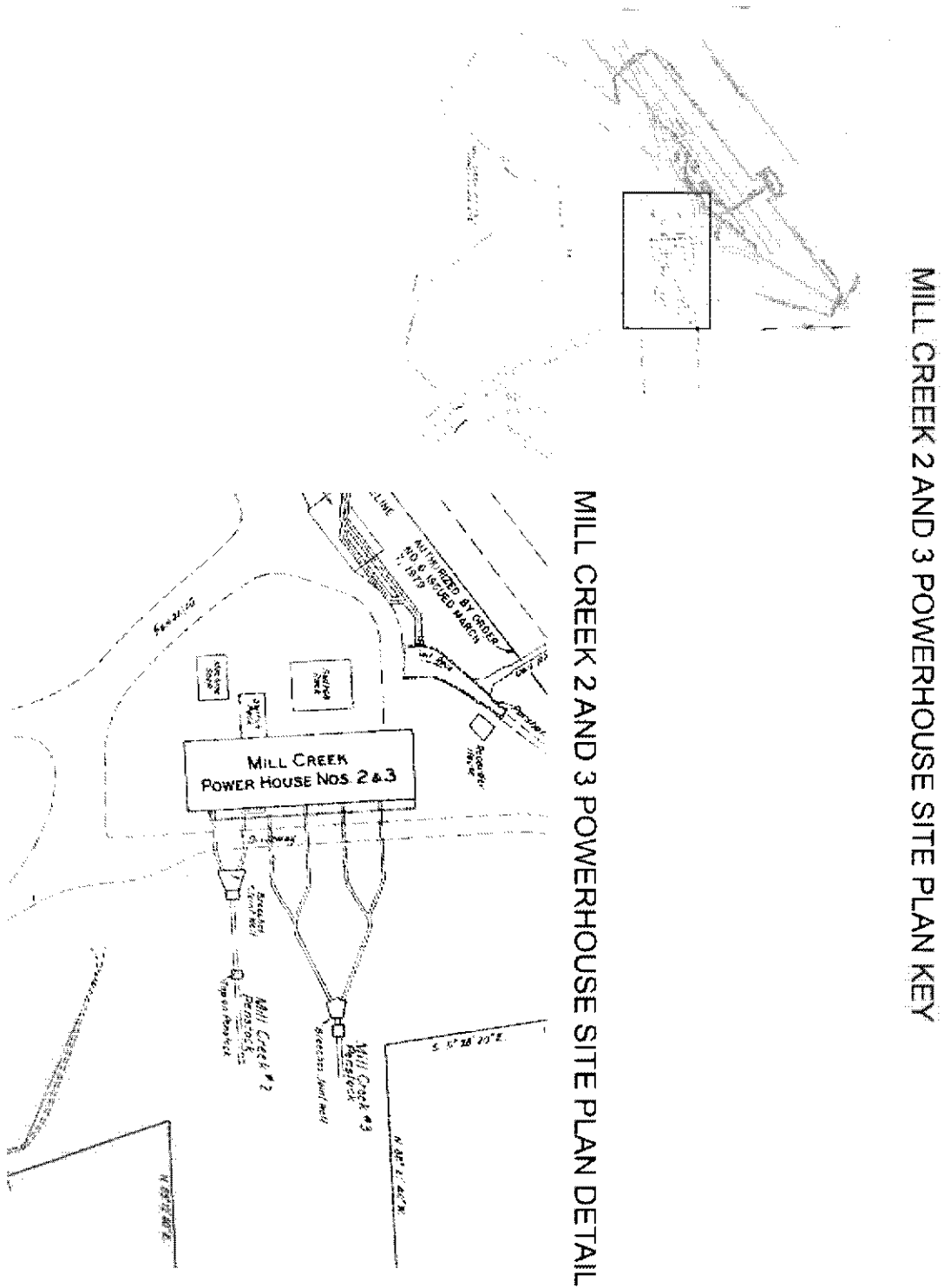
Location of Mill Creek Hydro Project Elements. (Map Courtesy of Southern California Edison)

Overview map of Mill Creeks 2 and 3 from circa 1903 using data from surveys conducted by F.C. Finkle (Courtesy of Southern California Edison)

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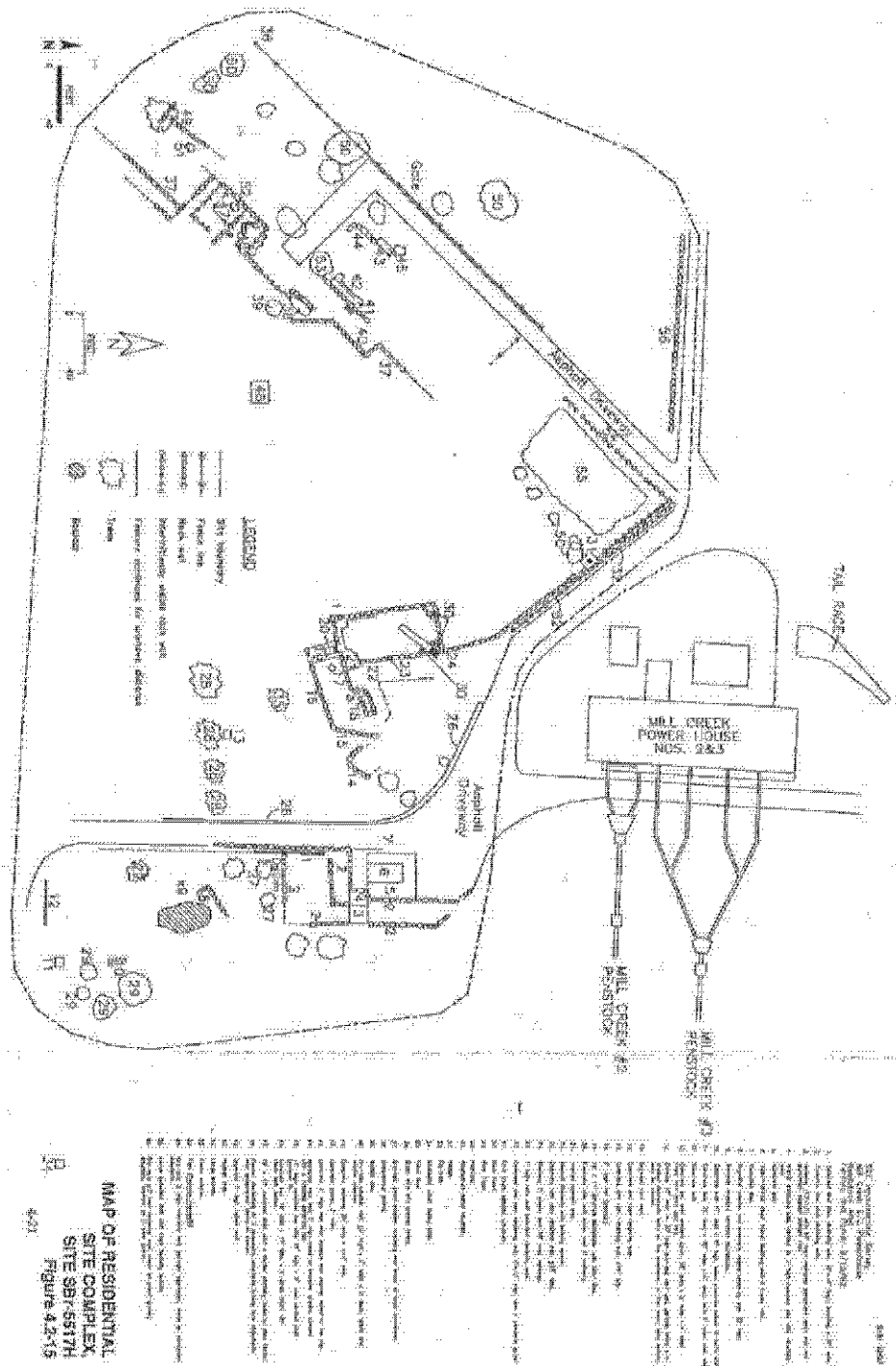


Overview Site Map of the Mill Creek 2 and 3 Powerhouse Site and Mill Creek 3 Intake. (Map Courtesy of Southern California Edison)

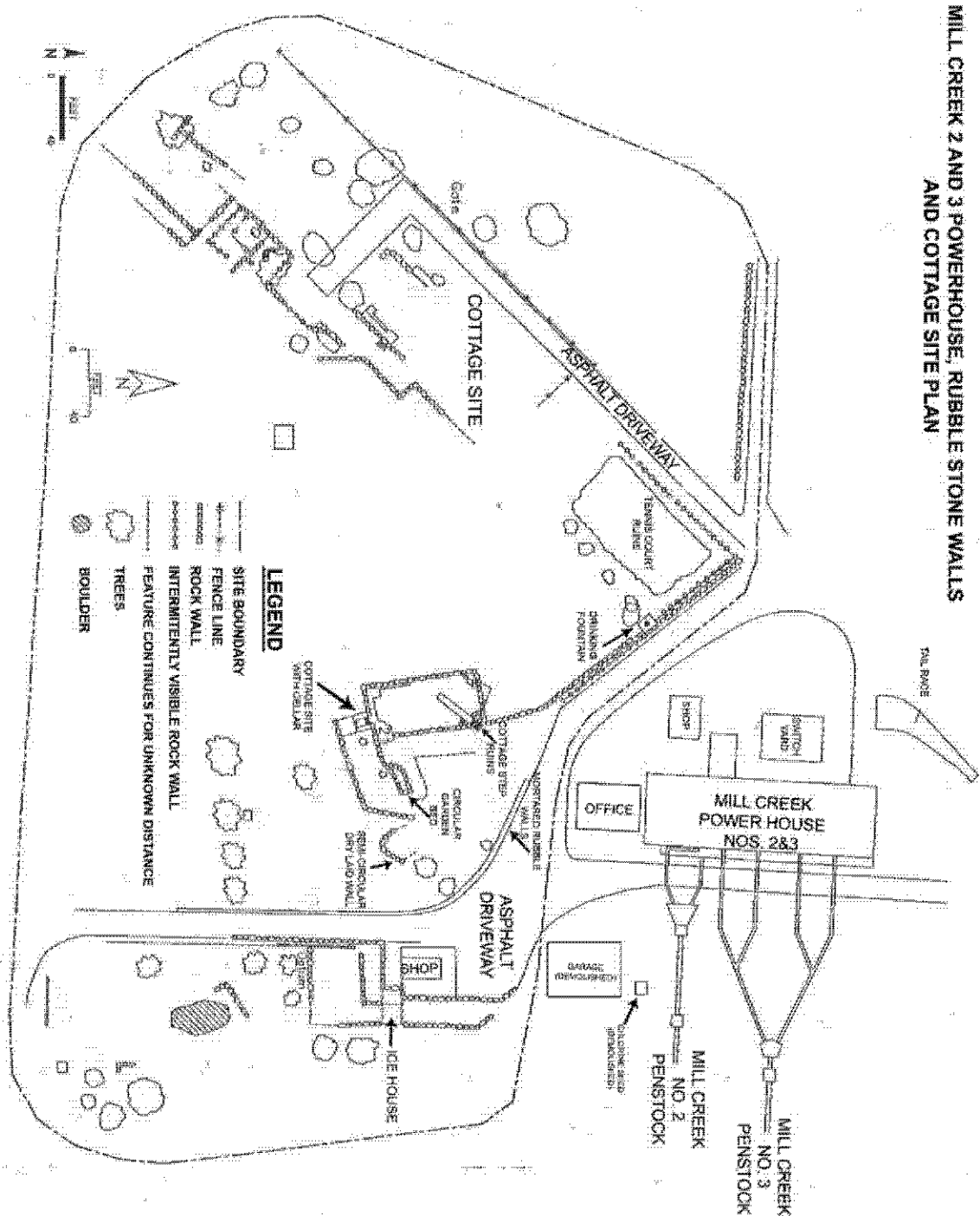


Mill Creek 2 and 3 Powerhouse Site Plan (Drawing Details Courtesy of Southern California Edison).

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Site Map of the Mill Creek 2 and 3 Powerhouse Site (Map Courtesy of Southern California Edison)



Mill Creek 2 and 3 Powerhouse Site Plan.

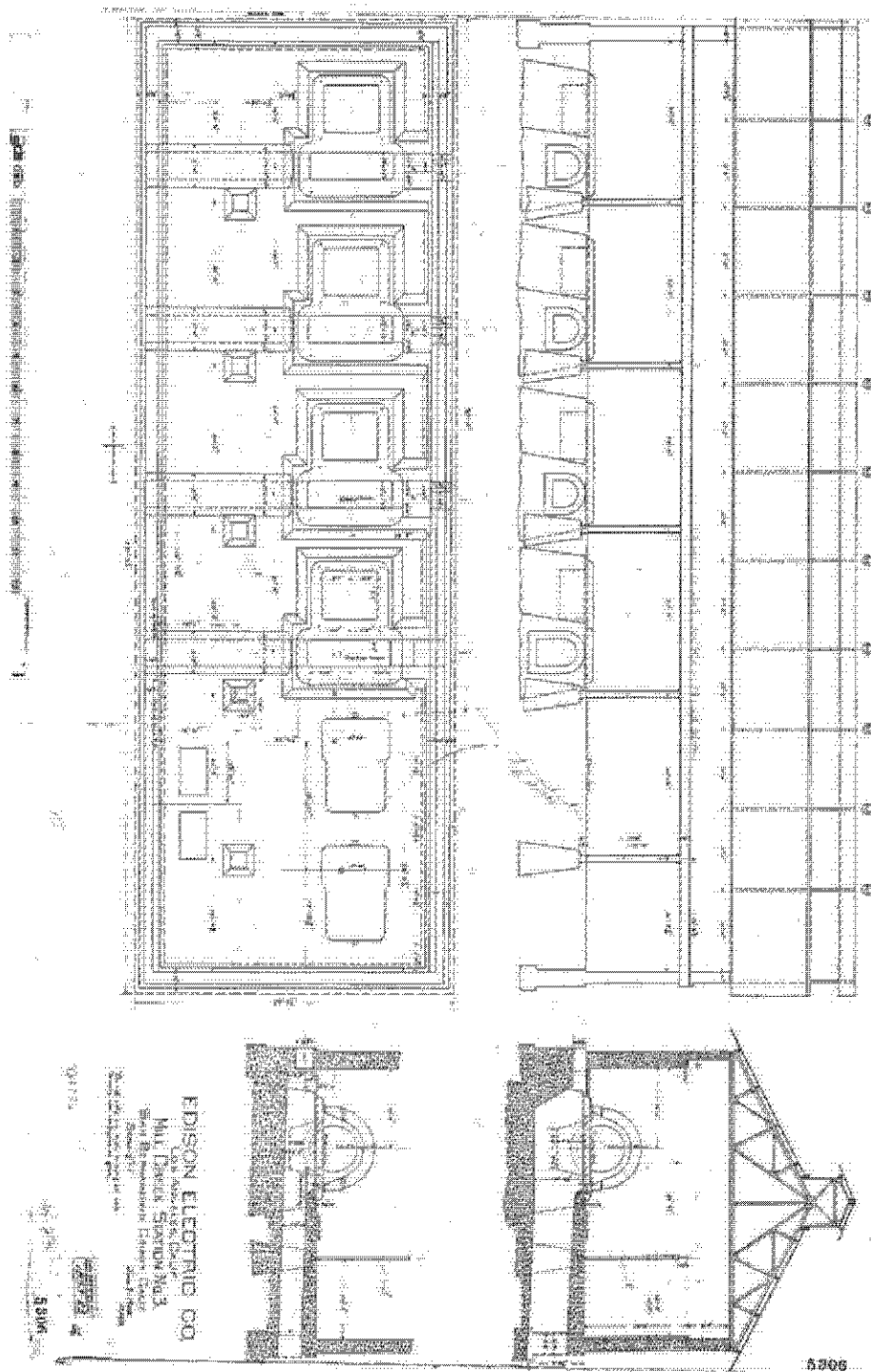
Powerhouse Plot Plan from March 26, 1928. (Plan Courtesy of Southern California Edison).



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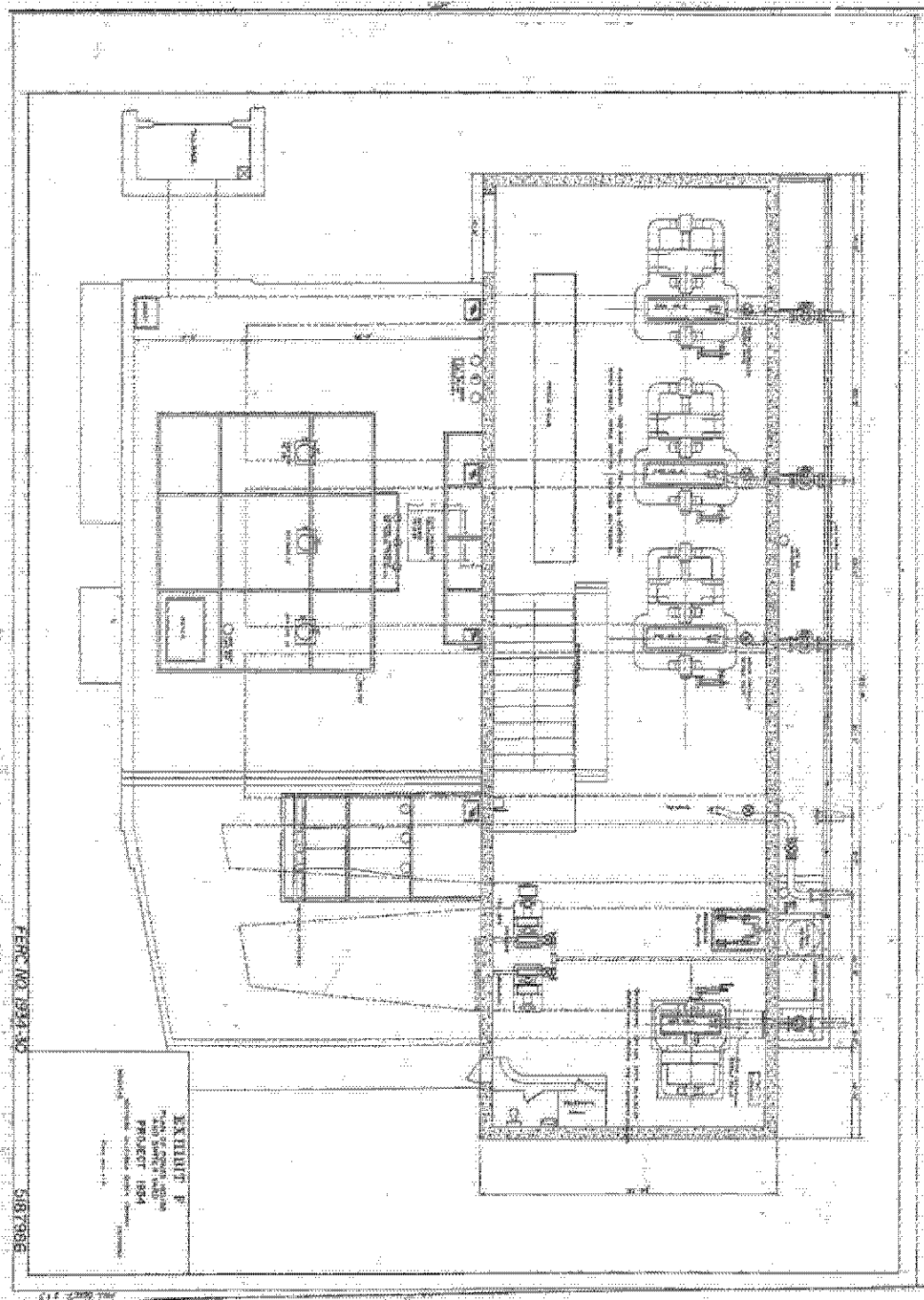
Mill Creek 2 and 3 Powerhouse Site Plan from February 11, 1941. (Plan Courtesy of Southern California Edison).

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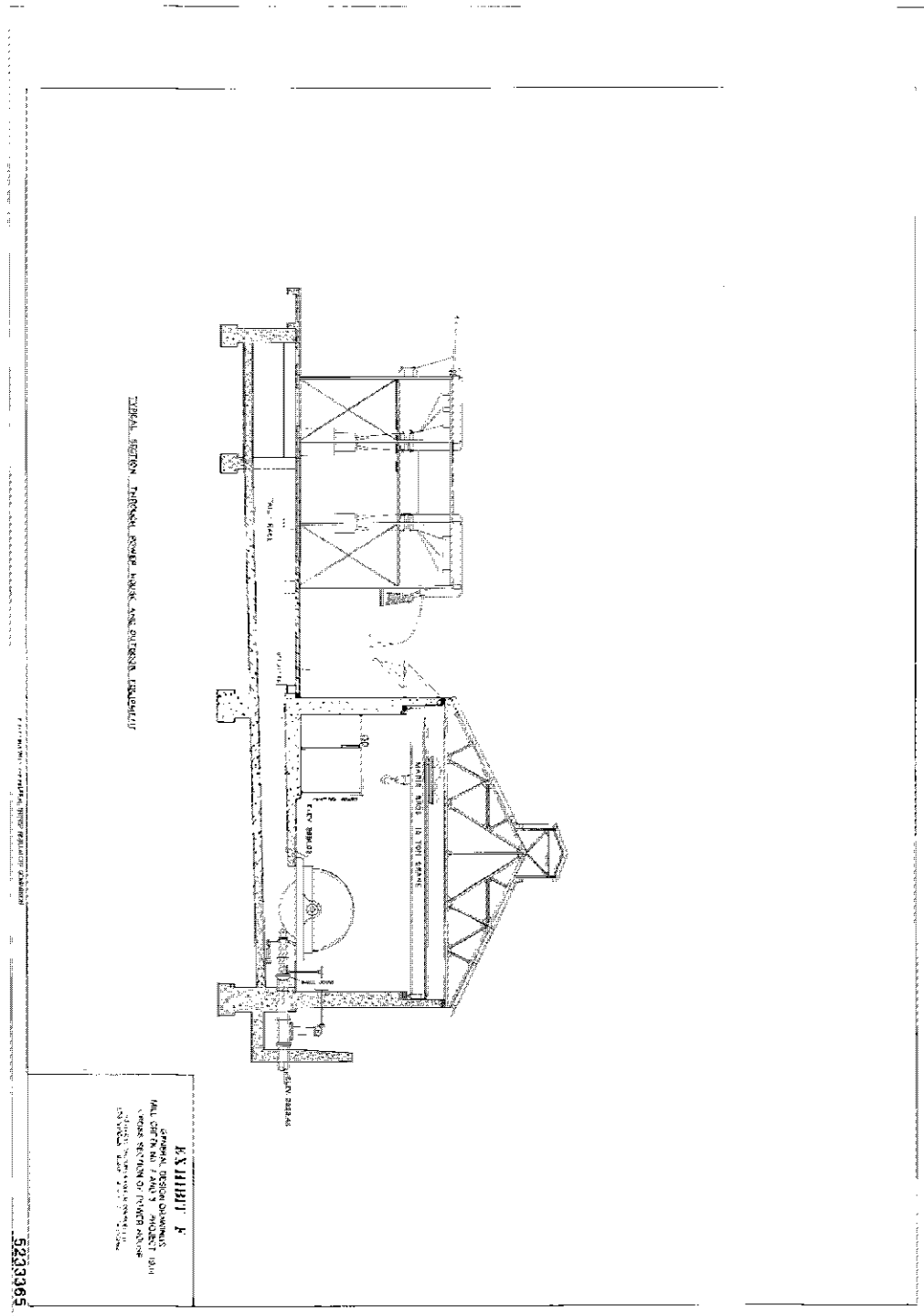
Plan, and Section of the Mill Creek 3 Portion of the Powerhouse. Plan view shows the two original Mill Creek 2 generators in the southeast corner. (Drawings Courtesy of Southern California Edison).

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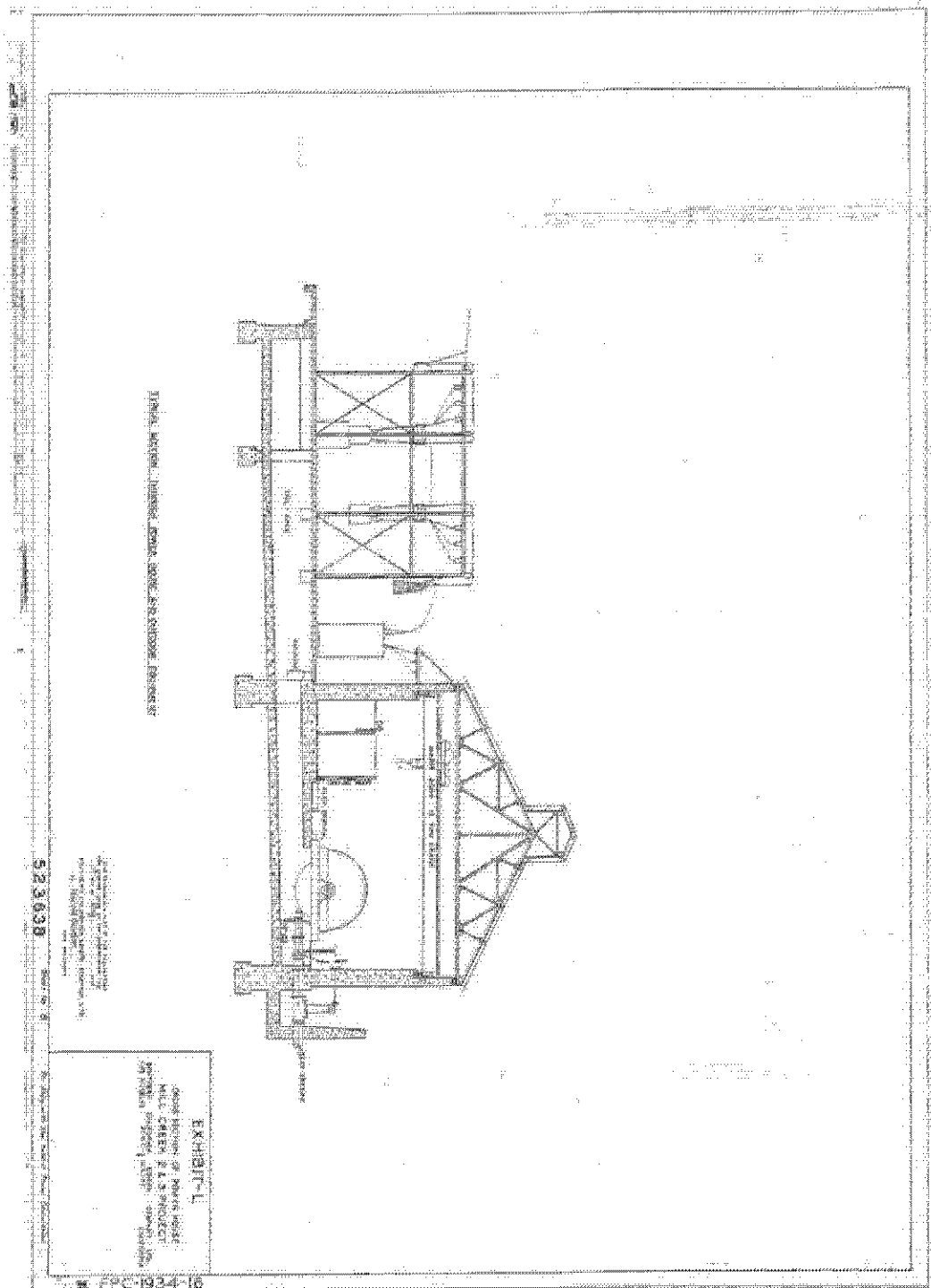
Plan of Powerhouse and Switch Yard, illustrates the current plan layout for the MC 2 and 3 Powerhouse. (Map Courtesy of Southern California Edison)

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Typical Section Through Mill Creek 2 and 3 Powerhouse and Outdoor Equipment. (Drawing Courtesy of Southern California Edison).

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Cross Section of the Mill Creek 2 and 3 Powerhouse. (Plan Courtesy of Southern California Edison)

Plan of Roof Truss for Mill Creek 2 Powerhouse (Plan Courtesy of Southern California Edison).